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MINERALS' SHARE IN THE WAR[1]

By D. N. WADIA

THE Indian Science Congress meets to-day for the fourth time since the beginning of the war. This meeting, only a few hundred miles remote from one potentially active war theater, is an event which bears significant testimony to the place science has won in India. The attendance of so many members drawn from many fields of scientific activities and Government institutions from almost all parts of the country, provides gratifying proof of their devotion to the cause of science and of their subscribing to its exacting ideals. Calcutta has once again made its contribution to the spread of science in India by inviting the congress for the sixth time. We keenly appreciate the warm hospitality it has accorded us under conditions of difficulty we all realize, and it is no mere formal expression of thanks that in your name and on your behalf, I tender to the organizers of this session. A distinguished citizen of India was to have presided at this meeting and no one here shares, more keenly than I, in the disappointment at his absence to-day. I seek your forbearance at my having to address you because of an existing rule which requires your president of the foregoing year to continue in office until its assumption by his successor. Pandit Jawaharlal Nehru's contributions to science in India have not been in the limelight, but they have been a leavening influence in the organization and working of the National Planning Committee, which, since 1939, is engaged in the great task of coordinating applied science with productive industry in every field, industrial, educational, cultural and organizational. Ladies and gentlemen, please believe me, I sympathize with you for having missed his rousing address.

Death has removed from our midst during the year several distinguished workers in different fields of science. The Indian Science Congress mourns the deaths of Rai Bahadur Ramprasad Chanda, anthropologist, archeologist and student of Indian art; Rai Bahadur Sarat Chandra Ray, Tibetan scholar, archeologist and founder-editor of *Man in India;* Mr. Gauripati Chat-

[1] General presidential address before the Thirtieth Indian Science Congress, Calcutta, 1943.

terjee, meteorologist, distinguished for aerological researches in upper air; Dr. G. de P. Cotter, late of the Geological Survey of India and a past president of the Section of Geology; Colonel Sir Francis Younghusband, reputed soldier, Central Asian explorer, geographer and a close student of Indian philosophy.

Reviewing the events of the year that has passed, the most outstanding and dominating event was the approach of the war to the doors of India. For the first time in the 4 millenniums of recorded Indian history, the enemy has assaulted the Eastern frontiers of the country. By sea, land and air our 2,000 miles long eastern walls have been approached and threatened by the invading enemy. But equally significant in the annals of 1942 was India's answer to the invaders, the answer conveyed through its munitions factories, electric, chemical and the host of technical plants, industrial research laboratories and the hundreds of young university-trained men manning engineering, medical, naval and air corps during the year. This may truly be regarded as the greatest event of the last few years in the cultural life of the country—for the first time after her age-long belief in the force of philosophic and spiritual striving as the goal of life, India has taken up the challenge of science and the machine and is adjusting itself intelligently and conscientiously and with surprising quickness to compose a society in which striving for both material and spiritual well-being are equally regarded as ruling factors in a perfect life. That indeed is an ideal difficult to achieve for any people, but in present-day India the change-over is taking place at a remarkably accelerating pace. Indian scientists by their last thirty years' work in different branches of science have made a notable contribution towards fostering the new mental attitude which has brought about this difficult welding. Lord Linlithgow happily expressed the need of such welding for the people of the East as well as the West in his opening address before the Jubilee Session of the Indian Science Congress held in Calcutta in 1938. "Even the most enthusiastic believer in Western civilization must feel to-day a certain despondency at the present failure of the West to dominate its scientific discoveries and to evolve a form of society in which the material progress and spiritual freedom march comfortably together. Perhaps the West will find in India's more general emphasis on simplicity and the ultimate spirituality of things, a more positive example of the truths which the most advanced thinkers of the world are now discovering." To this consummation philosophy and science must aim if the one is not to end in ultimate futility after ages of persistent effort and the other not to achieve, as a reward of its magnificent discoveries and inventions and its conquests over nature, a barren desert of frustration through a succession of world wars.

MINERALS' SHARE IN WAR

A geologist's work during war time is largely mobilizing all mineral resources in his own limited sphere for munitions purposes. Free international movement of minerals having ceased, every country has to produce the full quota from its domestic mineral resources. Far-reaching questions will arise in the near future, if indeed some have not already arisen, as to how long minerals from accessible depths of the earth will be able to sustain man's wars.

Man's advancement to civilization from the hunter and peasant stage is due to his mastery over metals and minerals, but this advance has caused most serious inroads on the world's stock of minerals and especially of metals. During the century and quarter between the Napoleonic wars and the Hitlerian war, the consumption of minerals has been over a hundred-fold of that consumed during the entire history of man on earth and so far as metals are concerned, man has used up between 1914 and to-day, between the two German wars, more metals than during any previous period of history. Metals such as tin have almost reached depletion stage, silver is being made to stand substitute for tin, while the extractable stock of platinum, silver and gold left for future needs of the world within manageable depth will be very meager. The consumption of fossil fuels, coal and petroleum has been at a far more serious rate, so serious that the world's known reserves of mineral oil at the present rate of production will be exhausted in a few decades. The total world coal reserves are larger, but they will last only a few decades longer, if the present acceleration of production and consumption of coal and its use for the ever-lengthening catalogue of by-products continues in the future at the same rate. So far no checks have been devised for this alarming depletion of the world's underground wealth, and this robbing of the earth by the living generation at the expense of future generations. Metals and minerals are a rapidly wasting asset of a country for which there is no renewal or replacement. Agricultural and forest resources of a land can be rejuvenated by suitable measures and manures, but no fertilizer can revive one exhausted mine, for geological processes are exceedingly slow, requiring hundreds of thousands of years to form a vein of metallic ore or a bed of coal.

There are some 1,500 distinct species of minerals known; of these about 200 find application in commerce and industry and are considered economic minerals. Among these again there is a rapidly mounting list of metals and minerals which are of vital use in the manufacture of munitions of war and of highly specialized commodities of strategic use. In the defence program of a nation under the present-day conditions of totalitarian warfare, the metallurgical

industry and its ancillary mining of minerals yielding the ferrous and alloy metals, fluxes, refractories and accessory minerals are of essential importance. A significant feature of the distribution of these minerals is the concentration of their production and manufacture in a comparatively few countries in the world, happily nearly three fourths of these being centered in, or controlled by, the United Nations as against the Axis group. Of the total annual mineral production of the world in pre-war years as much as 85 per cent. came from North America and Western Europe, of these the United States, England and Germany and latterly Russia contributing over 75 per cent. This, however, does not mean that nature has endowed these countries to this unequal extent with valuable minerals; it rather is an index of the country's industrial and technical development and the energy of the people. Russia's three successive five-year plans are an example of this. Industrial progress of other parts of the world may materially change this condition. For instance, China's vast reserves of coal, hitherto untapped for lack of economic employment, may, in the not distant future, be put to use in metallurgy, or in the production of heat energy or other profitable channels. India's resources in iron-ore are of a magnitude quite out of proportion to the bare couple of million tons of pig iron per year it has only recently begun to produce. Only in a few districts of Bihar and Eastern States Agency, the high-grade iron-ore reserves are calculated to be of the order of 4,000 million tons. Large reserves of aluminium-ore are still only potential assets. The minerals of South America and Africa are yet in an early stage of development, while Australia's store of mineral wealth is yet unknown over wide tracts of that region. When these untouched reserves enter production stage, the apparent inequalities will diminish and the countries bordering the North Atlantic basin will not occupy the dominating position in strategic minerals they do at present.

But even so, when the whole world's mineral resources are fully known and mobilized, the stock will not last many generations, if it is made to feed the waste of recurring wars on the scale of magnitude and frequency of the last two world wars. If the supply and free movement of a few ferro-alloys and a few strategic key minerals for non-industrial uses is controlled by some central world organization, the demon of totalitarian war can be banished and the remaining wars shorn of their insane waste involved in military as well as non-military devastations. Then the wreckage of tanks and armor-plates can be beaten back into ploughshares and its superior steel released for beneficent uses in peace.

It is no exaggeration to say that half of the later wars of history have been directly or indirectly motivated through the desire of gaining access to stores of strategic mineral products, ores, fuels, salts, alloy metals and essential industrial minerals.

The international mineral situation during pre-war years was in a chaotic state. While the United Nations were in a state of "vacuous unawareness" about it, the Axis powers grabbed as much of the indispensable munitions minerals as they wanted and the war has been waged by them on the stores of hoarded minerals and metals.

Only the adoption of a wise and justly planned international mineral policy framed by an international directorate can preserve peace and goodwill amongst countries unequally endowed by nature with mineral wealth. No country in the world, however well supplied it be, is self-sufficient in mineral requirements, nor is any so situated that it can regard its mineral resources as purely domestic or national. Embargoes, tariffs, patent rights and transport controls imposed for political reasons do not offer a solution, but by hindering free movement of minerals become powerful contributive factors in precipitating world wars. Unequal geographical distribution of minerals being an unalterable fact, planned international economy should devise means not only to eliminate this cause of inter-country friction but to increase the interdependence of nations on each other for their vital trades and industrial needs and so make minerals a rallying point for international cooperation and goodwill. The preliminary recommendations of the Conference on Mineral Resources and the Atlantic Charter convened by the British Association's Committee on Social and International Relations of Science last July, appear to be on the right lines, but they will not go far enough if their implications are meant to safeguard the interests of the British Empire only, or even of the whole United Nations' group. These should embrace all the free countries and should call for sacrifice from all participating nations of part of their national and natural advantages for the ultimate benefit of all and the future security of the peoples of the world. The main resolution of this conference reads as follows:

> This Conference, having specifically dealt with mineral resources, submits that, as a first step, the Council should initiate forthwith consultations with appropriate scientific and technical organizations, to secure an understanding on the principles involved. The Conference would further urge that a scientific review of mineral resources, using and supplementing all existing data, should be among the first tasks of any international organization for the social applications of science, such as was envisaged at the recent Conference on Science and World Order. To this end, the Conference recommends that the Council should consider how it might help

to promote the establishment of an International Resources Organization, as a fact-finding and advisory body for Governments, as a contribution to world stability, and in the spirit of the Atlantic Charter.

The fourth article of the Atlantic Charter postulates access for all states on equal terms to the raw materials of the world. But if the Atlantic Charter does not unreservedly provide for all peace-loving nations of the earth, whatever oceans bound them, its fulfilment in a partial degree will not achieve the goal of post-war minerals allocation, nor succeed in removing a focal infection point in the body politic of the world.

The position of mineral affairs to-day being what it is, it behoves us as non-Utopian science workers to ask —what is India's place in the world's mineral map? The mineral outlook of the Indian region is on the whole satisfactory both for war and peace-time requirements. India's resources in minerals of strategic importance, minerals for munitions and defence armaments, base metals, alloys, fluxes, refractories and accessory minerals can be regarded as adequate, in several but not all of them. India is deficient in tin, tungsten, lead, zinc, nickel, graphite and liquid fuels. But in the basic metals, iron, manganese, aluminium and chromium, the country is well supplied, in the case of the former three, in large excess. Our neighbor, Burma, has abundant stocks of the munition metals of which India is in defect, while her oil resources must yet be regarded as considerable. Ceylon has reserves of the world's finest graphite, a mineral indispensable in metallurgy and of a magnitude sufficient to last a long period. Ancillary minerals such as asbestos, cement, fertilizers, clays, mica, sulphur, various salts, ores and other minerals of industrial utility are available in quantities sufficient for the country's needs, while some are in exportable surpluses.

The experience of the last three years' war effort in the production in India of a wide range of munitions, without any previous apprenticeship, is satisfactory proof of the country's adequacy in some respects, though still unequipped in a number of essentials, *viz.*, specialized steels, machine tools, manufacture of aircraft, high explosives, automobile engines, big ship construction, etc., on a scale commensurate with her internal requirements.

The Social Obligations and Relations of Science in India

Last year, while addressing you on the progress of the exact sciences in India during the last 30 years, I stated that the retrospect was satisfying and held out promise of further developments. The time, however, has come, and the events of the last few years forcibly remind us of the fact that science, as pursued in the laboratory and the field, is becoming more and more a specialist's job and is becoming divorced from the life of the people. Science, as applied to the problem of daily living and the social needs of the common man, is the great necessity of the day. The advent of the motor bus, the radio and railway engine in the villages of India is not the same thing as bringing science to the homes of our villagers. The impact of science on the Indian masses has come in the form of a rather rude intrusion of machines and mechanics into the essentially simple rural economy of the country and it is not surprising that this meeting has not been a particularly happy one. It has disturbed the economic structure and created, if not some aversion, an indifference to the cult of science in the popular mind. But we all know that science is not all mechanics nor are its practical uses to man the greatest thing about science. The greatest thing about science is the scientific method—the most effective thing man has for discovering truth and the ways of nature. It can bring solid benefits by releasing life from stagnation and the bonds of ignorance wherever these prevail, whether in cities or in the country-side, among the laboring masses or among the governing class. The awakening to the social obligations of science is of recent date and even in Europe and America, this aspect of the cultivation of science was for long not realized and left to sporadic individual efforts. With this awakening, a two-fold problem faces science all over the world to-day—to press the newest discoveries and inventions of applied science into the service of agriculture, manufactories, hospitals, homes and schools and alongside with it to so control the impact of these on his private life that his mechanized work-a-day life may not be totally divested of all higher spiritual values. Our future national life and its material well-being largely depend on a wholesome balance being maintained between these two—the impulse to harness science to increase physical comforts of life and a restraining desire to preserve the old-world spiritual calm and simplicity of living. Happily for India, this balancing is somewhat of a natural hereditary trait and does not need much emphasis. While in the European countries the evolving of a true synthesis, a *via media,* demands much searching and learned arguing, our age-old traditions have made this work easier. India's late start in the application of science to industry also gives it an opportunity of planning along right lines. The significance of this problem has been realized by both our political leaders, as well as scientists, and some progress is made in this direction. I refer to the inauguration in 1939 of the National Planning Committee under the chairmanship of Pandit Jawaharlal Nehru, with the specific object of coordinating science with industry in all its phases and to the establishment by the Indian Sci-

ce Congress at its Lahore session in January, 1939, a subcommittee on science and social relations, mainly with the object of studying the influence of ience on India and collecting data relating to the ffects of science on society in India.

The National Planning Committee, through its 29 ubcommittees, has set out on formulating a program overing many phases of the country's future life nd activities, material, productive, educational, artis- ic. Their work unfortunately is in a great measure uspended to-day, though some of the 29 subcommit- ees have furnished more or less complete, well-docu- ented reports, while others have submitted interim act-finding reports. Their conclusions, doubtless, will e subjected to thorough revision and deliberation by he main body which comprises 200 of the leading in- ustrialists, publicists and scientists of the country, before they are offered to the public, but a great deal of spade work is accomplished, a valuable mass of ascertained classified details collected and many blue- prints prepared. A planned reconstruction in a greater or less measure of India's commerce, industry, finance, land labor, mining, transport, power-genera- ion, technology alongside educational, cultural and ocial reorganization is expected to emerge from the abors of this body.

Proposed Academy of Social Sciences for India

The executive committee of the Indian Science Congress has before it a proposal for the institution of a National Academy of Social Sciences drawn up by the subcommittee on science and social relations. It is interesting to trace the origin of this subcommittee which goes back to the Blackpool meeting of the British Association for the Advancement of Science in 1936, which meeting was devoted to the discussion of the social relations of science. In the following year, a few leading science associations took cognizance of this subject. The International Council of Scientific Unions, with its headquarters at Delft, Holland, at its meeting held in April, 1937, in London, established a Committee on Science and Social Relations with Professor F. G. M. Stratton, of Cambridge University, as president. This action of European scientists was followed by a resolution passed by the American Association for the Advancement of Science at its meeting in 1937 urging the various scientific organizations of the world to reundertake examination of the profound charges brought about by science in human society and thus be in a position to promote "peace among nations and intellectual freedom in order that science may continue to advance and spread more abundantly its benefits to all mankind." In 1938 the British Association at its meeting held at Cambridge brought into being a special Division for Social and International Relations of Science with Sir Richard Gregory as its chairman. This division organized a conference on "Science and the New World Order" in London during September, 1941. In conjunction with these sister organizations of Europe and America, the Indian Science Congress instituted a subcommittee on science and social relations at its annual session held in Lahore in January, 1939. This subcommittee has been working for the last three years and its labors have fructified in the above proposal which in due course will come before the Indian scientists and to which they will have to give their most careful consideration.

The proposed academy should be a body of high academic standing and professional knowledge, which can take up long-range problems of social well-being of the people or India which the older societies and associations, established along familiar but too general lines in some cases and rather over-specialized lines in others, can not deal with without suspicion of religious or political bias. Socio-medical and political subjects, human relations, anthropology, political science, vital statistics, social biology, population problems, sociological research in particular bearing on various Indian communities are the subjects on which such an academy can work in collaboration with the Indian Science Congress and half a dozen other institutions already existing in the country for some of the above-named specific objects. It can be a living organ in the body politic of India for voicing the collective opinion and focussing the specialized points of view of numerous isolated working bodies on the one problem how to promote the well-being of the common man. The subcommittee has begun a survey of the status of sociological studies in all the Indian universities. Vice-chancellors of many Indian universities have endorsed the proposal about the academy favorably, and the secretaries of those learned societies that have been approached have announced their readiness to cooperate. Dr. K. Motwani, the secretary of the subcommittee, personally placed the scheme before Pandit Nehru last July and, in accordance with Pandit Nehru's wishes, the executive committee proposes to appoint a committee of experts to suggest ways and means of bringing this academy of social sciences into being. The matter rests here. It is too early to outline the exact task to which the academy will address itself. Its chief function will be to explore those avenues through which the contributions of science may be adapted to the life of the individual and the nation without allowing any anti-social applications of science such as have made a shambles of so many countries, ever raising their heads in our midst. Secondly,

the academy should emphasize an integrated, synthetic approach to every problem, pressing into service the contributions of various basic social sciences such as human geography, anthropology, psychology, economics, political science, philosophy and sociology. The bringing into being of a national academy so constituted may well become a crowning achievement of the Indian Science Congress.

OBITUARY

JOHN OTTERBEIN SNYDER

DR. JOHN OTTERBEIN SNYDER, professor of zoology, emeritus, at Stanford University, died in Palo Alto, California, on August 20, 1943. Professor Snyder was born in Butler, Indiana, on August 14, 1867. He is survived by his wife, the former Frances Hamilton, and two children, Corporal Cedric O. Snyder, U. S. Medical Corps, and Evelyn Hamilton Snyder, of Palo Alto.

Professor Snyder's boyhood was spent in the town of his birth, where he received his early education. In 1890 he went to Indiana University. There, as a freshman, he came under the stimulating influence of the late Dr. David Starr Jordan, became interested in the study of fishes and followed Dr. Jordan to Stanford in 1892. From that time until his death he was closely associated with the Stanford community, first as student, later as teacher, administrator and citizen. In each role he played a leading part.

From the year before his retirement from the university (1931) to 1937 Professor Snyder was director of the Bureau of Fish Conservation of the California Division of Fish and Game. His understanding of the fundamental biology involved and his genius for organization resulted in a complete revision of the work of that bureau along scientific lines. On retirement from the service of the state, he left the administration of the bureau in the hands of a former graduate student whom he had selected and trained especially for that work.

Professor Snyder's more serious research interests were broadly in the field of ichthyology; he was the author of many papers dealing with systematic ichthyology, with the distribution and life histories of freshwater fishes and with fisheries biology. In his systematic work he was especially interested in the finer differences shown by closely related forms, and in some of his earlier papers he developed methods for studying series of specimens that foreshadowed the present statistical approach to similar problems. His studies of the salmon of California were of special importance in providing a scientific background for his conservation work with the California Division of Fish and Game.

As a young man Professor Snyder took part, as ichthyologist, in a number of important scientific expeditions. He accompanied Dr. Jordan on trips to Mexico, Hawaii and Japan, and served as naturalist on the U. S. Fish Commission research vessel *Albatross* at various times between 1902 and 1906. Until 1916, he was at frequent intervals associated as assistant with the Fish Commission and with the succeeding Bureau of Fisheries. In 1914 and 1915 he served as ichthyologist in the U. S. National Museum and in 1925 was appointed director of the Marine Biological Laboratory of the Bureau of Fisheries at Woods Hole, Massachusetts. He was an active member of the California Academy of Sciences and was corresponding secretary for a number of years beginning in 1920. Professor Snyder was always keenly interested in the general welfare of the communities in which he lived. At Stanford University he served actively on various academic committees. He was a member of the city council of Palo Alto from 1917 to 1922. During World War I he quietly rendered services to the nation that were known only to a limited number of close associates.

As a youth, J. O. Snyder was widely interested in nature—in the geology and biology of his native Indiana. This interest sharpened his naturally keen powers of observation, and he developed into a superb field naturalist. This interest in the things of out-of-doors he retained throughout life. During the years of his teaching at Stanford his courses in ornithology, always popular with students, provided for many of them a source of pleasure that carried over into their lives long after their leaving the university.

His understanding of, and helpful interest in, the younger men and women who came under his influence were conspicuous traits of his character and inspired many of his students to an abiding interest in biology. It was characteristic of these interests that he regularly organized field expeditions, many of which lasted for several months, and on which he took one or more younger men. His methods in the field were systematic, thorough and ingenious, and his field notes were models of accurate observation and careful recording. The training he gave on those trips, chiefly by example, was incomparable. And training apart, the delightful comradeship and the refreshment of those days in the open with "J. O." has remained a high light in the lives of many of the students who were privileged to experience them.

WILLIS H. RICH

STANFORD UNIVERSITY

DEATHS AND MEMORIALS

DR. ELMER DARWIN BALL, dean of the College of Agriculture and director of the Agriculture Experiment Station of the University of Arizona, who was on leave of absence on account of illness, died on October 5 at the age of seventy-three years.

GUSTAVE SAMUEL LINDGREN, director of the U. S. Weather Bureau at Albany from 1926 to 1940, died on October 13. He was seventy-one years old.

SAMUEL HARDEN CHURCH, since 1914 president of the Carnegie Institute, died on October 11 at the age of eighty-five years.

DR. MAX WERTHEIMER, psychologist, member of the graduate faculty of political and social science of the New School for Social Research, died on October 12 at the age of sixty-three years. He had been professor of psychology and philosophy at the University of Berlin and the University of Frankfort. He left Germany in 1933 after Hitler seized power and a few weeks before the dismissal of Jews from the universities began.

DR. CECIL ROWNTREE, British surgeon and vice-president of the International Union Against Cancer, died on October 14. He was sixty-three years old.

THE death on October 5 at the age of sixty-one years is announced of Dr. Walter Medley Tattersall, professor of zoology at South Wales and Monmouthshire University College at Cardiff.

DR. PIETER ZEEMAN, until his retirement professor of physics and director of the Institute of Physics at the University of Amsterdam, died on October 9 at the age of seventy-eight years.

THE fifth in the series of oil paintings designed as a monument to American medical pioneers and sponsored by Frank F. Law, president of John Wyeth and Brother, will be unveiled in Philadelphia on November 5 during National Pharmacy Week. The painting is a tribute to William Procter, Jr., American pharmacist known for his work for drug standardization. The official title of the painting is "The Father of American Pharmacy."

SCIENTIFIC EVENTS

THE ACADEMY OF SCIENCES OF THE U.S.S.R.

THE Academy of Sciences of the U.S.S.R. opened its general session on September 25. In an interview, Vladimir Komarov, president of the academy, made a statement, which reads in part as follows:

From the very beginning of the Patriotic War the Academy of Sciences of the U.S.S.R. adapted its work to the demands of the front. The attention of scientists was directed toward coordinating the problems on which they were working with the needs of the country's defense and the national economy.

The presidium of the academy organized committees for mobilizing the resources of the Urals, Western Siberia, Kazakhstan and the Volga and Arctic regions, a committee to locate reserves and a committee for geological and geographical aid to the Red Army. The work of these committees had considerable practical results. In order to establish closer contact with industry, institutes of the academy allocated their scientific workers among various industrial enterprises. Great attention was paid to utilizing in production the results of completed research.

The Academy of Sciences of the U.S.S.R. is working on problems connected with the re-establishment of economic life in areas freed from the German occupationists. The Mining Institute has practically completed technical plans for restoration of the productive power of the Donets and Moscow coal basins. The Institute of Geological Sciences has drawn up a report on the geophysics of the Donbas, pointing out new areas which may be explored and exploited. The Institute of Metallurgy has solved a number of problems connected with the rebuilding of the metallurgical industry in the south and the obtaining of new raw materials. The institute's researches deal with the setting up of open-hearth steel-smelting, rolling and pipe-rolling processes and the production of steel alloys. Scientists in the field of transport have worked out problems affecting the restoration and development of railroads and other means of transportation.

The division of biological sciences has devoted considerable attention to improving medical and sanitary work in the Red Army and the rear. Effective methods have been developed for dealing with various complications arising from wounds such as shock, hemorrhage and nervous reaction.

In the first half of the current year 154 scientific studies were completed in various divisions of the academy. The Government has marked the scientific activity of many of the academy members. Academicians A. N. Krylov and N. N. Burdenko were honored with the title of Hero of Socialist Labor. Stalin prizes were awarded this year to 32 academicians, 11 corresponding members and 13 professors and research workers of the academy.

At this general session of the academy a report was made on scientific activity in 1942 and 1943, and the main trend of work for 1944 was determined. A number of papers were read by outstanding scientists. Supplementary elections of academicians were held, and those new corresponding members elected at meetings of divisions of the academy were approved. Of the 224 scientists proposed for membership in the academy, 36 will be chosen, and of the 467 candidates for corresponding memberships, 42 places will be filled. This large number of candidates testifies to the increasing growth of Soviet scientific cadres in wartime.

LIMITATION ORDER L–144

THE objects of the amendment to Limitation Order L–144, made on October 9, are to simplify and clarify the provisions of the order and to greatly reduce the number of applications to be filed by users of laboratory equipment. Important features of the amended order are:

(1) Restrictions are entirely eliminated on the delivery of:

(*a*) any item costing $50 or more (unless the item is included in List A of the order);

(*b*) a quantity of the same item costing $50 or more;

(*c*) a miscellaneous order aggregating $200 or more.

(2) No filing of Form WPB–1414 is required for any item costing less than $50.

(3) The filing of Form WPB–1414 under the order is now required only for instruments which are included in List A of the order. Every one, except a distributor, must file for items on List A. No filing is required for items of laboratory equipment not on List A.

(4) List A is reduced by removing several items formerly included and is clarified by using specific names of instruments rather than types, as was done in a few cases on List A of the previous order.

(5) The filing of applications on Form WPB–1414 is not required for accessories and attachments, when purchased separately, even if the instrument with which they are to be used is included in List A.

(6) No application is required for parts or materials to be used for repair and maintenance of existing instruments or for secondhand equipment.

(7) The definition of a distributor is amended to include distributors in the Dominion of Canada. Arrangements have been made with the Department of Munitions and Supply in Canada so that both the distributor and the user of laboratory equipment in Canada will operate in the same way as those in the United States.

(8) When authorization on Form WPB–1414 has been received, certification in accordance with paragraph (d) (2) of L–144 must be sent to the supplier together with authorized preference rating. The authorization copy of Form WPB–1414 should be kept by the applicant and not be sent to the supplier.

(9) Limitation Order L–144, like other limitation orders, does not cover the subject of preference ratings, but the fact should be borne in mind that only the preference ratings assigned by orders listed in Priorities Regulation No. 3, List B Item 21, or a specific preference rating, such as that authorized on PD–1A for a specific item, may be used in the purchase of laboratory equipment as defined in paragraph (a) (1) of amended Order L–144. Blanket MRO Ratings, such as ratings assigned by CMP Regulation No. 5 or 5A, may not be used for the purchase of laboratory equipment.

SAFETY AND TECHNICAL EQUIPMENT DIVISION,
WAR PRODUCTION BOARD,
WASHINGTON 25, D. C.

MELLON INSTITUTE TECHNOCHEMICAL LECTURES, 1943–1944

A SERIES of lectures on the status and outlook of American chemical and related industries, with particular reference to postwar planning, will be presented by specialists of Mellon Institute of Industrial Research during 1943–44. These discourses, which will be delivered on the Thursdays indicated, in the fourth period throughout both semesters, in the auditorium of the institute, will be open to all students in the professional courses in chemical engineering and chemistry in the University of Pittsburgh, as well as to members of the institute:

October 14, Dr. E. R. Weidlein, "Postwar Problems of the Chemical Industries."
" 21, Dr. H. J. Rose, "Trends in Fuel Technology."
November 4, Dr. H. J. Read, "Utilization of Low-Grade Ores."
" 18, Dr. L. A. Carapella, "Light Metals and Alloys."
December 2, Dr. D. F. Helm, "Powder Metallurgy."
" 16, Dr. G. H. Young, "Protective Coatings."
January 6, W. L. Glowacki, "Coal Distillation Products."
" 13, Dr. R. L. Wakeman, "Chemical Derivatives of Hydrocarbons."
February 10, Dr. B. B. Corson, "Catalytic Hydrogenation."
" 17, Dr. L. T. Sanborn, "Utilization of Wood Constituents."
March 2, Dr. J. A. Sauer, "Aviation Constructional Materials."
" 16, Dr. R. J. Sumner, "Cereal Products."
April 6, Dr. G. E. Helz, "Food Dehydration."
" 20, Dr. F. R. Holden, "Control of Industrial Health Hazards."

THE DIRECTOR OF RESEARCH OF THE WELLCOME FOUNDATION

DR. CHARLES H. KELLAWAY, F.R.S., director of the Walter and Eliza Hall Institute of Research in Pathology and Medicine, Melbourne, is reported in the *Australian Journal of Science* to have been appointed director-in-chief of the research activities of the Wellcome Foundation.

Dr. Kellaway has been director of the Walter and Eliza Hall Institute since 1923, and its world-wide reputation is largely the work of his hands. He will take the place of Dr. Wenyon, who was director-in-chief and also acted as director of the Tropical Disease Laboratories of the institution. Under the new arrangements Dr. Kellaway will be director-in-chief and Colonel N. Hamilton Fairley, when he can be released from the army, will direct the Tropical Disease Laboratories. Before the war, the Wellcome Foundation consisted of the Wellcome Research Institution in Euston Road, which housed an excellent historical medical museum and a museum of medical science, and also the Wellcome Bureau of Scientific Research. In

addition there were the extensive Physiological Research Laboratories at Beckenham directed by Dr. Trevan, the Chemical Research Laboratories at Snow Hill under the direction of Dr. Henry and an Entomological Research Laboratory at Ripley in Surrey. The foundation had a research organization at Khartoum and a laboratory for the investigation of malaria and black-water fever in Macedonia, which was founded by Dr. Fairley and taken over by the foundation before the war. Members of the board include Sir Henry Dale, president of the Royal Society, and Professor T. R. Elliott, F.R.S.; the chairman is Thomas Bennett.

After the war the Wellcome Foundation plans a vigorous policy of expansion. It is greatly interested in scientific intercommunication within the British Commonwealth of Nations and with the United States, where there is already a research laboratory. An extensive program of research in tropical medicine is proposed, in close cooperation with the London School of Tropical Medicine and the Colonial Office. Chemotherapy will be a major activity of the foundation.

THE AMERICAN-SOVIET SCIENTIFIC CONGRESS

A SCIENTIFIC congress in celebration of the tenth anniversary of American-Soviet diplomatic relations will be held on November 6, 7 and 8 at the Hotel New Yorker and Madison Square Garden under the auspices of the National Council of American-Soviet Friendship.

The scientific meetings will open on Saturday evening, November 6, with a public session on Planning and Post-War Reconstruction in the United States and the U.S.S.R. On Sunday, November 7, panels will be held on Soviet Science and Technology and on Public Health and Wartime Medicine in the U.S.S.R., the latter to be held under the auspices of the American-Soviet Medical Society.

The scientific congress, sponsored by leading scientific men throughout the country, has as its honorary chairmen Professor Walter B. Cannon, of Harvard University; Professor Ernest O. Lawrence, of the University of California, and Professor Gilbert N. Lewis, dean of the department of chemistry of the University of California.

Among those who have accepted invitations to speak are Professor L. C. Dunn, executive officer of the department of zoology of Columbia University, who will make an address before the section of Science and Technology, of which Dr. Harold C. Urey is chairman. The title of Dr. Dunn's address is "Russian Research in the Biological Sciences"; Dr. C.-E. A. Winslow, professor of public health at Yale University, will speak before the medical section on "Public Health in the Soviet Union," and Dr. V. A. Lebedenko, Russian Red Cross representative in the United States, will address the panel on medicine on "Russian Advances in Military Medicine."

CENTENNIAL OF THE OBSERVATORY OF THE UNIVERSITY OF CINCINNATI

THE observatory of the University of Cincinnati will celebrate its centennial on November 5, 6 and 7. The American Astronomical Society will hold its annual meeting in Cincinnati in connection with the centennial. Dr. Harlow Shapley, director of the Harvard Observatory, president of the American Astronomical Society and of the American Association for the Advancement of Science, will be the principal speaker.

The corner-stone of the observatory, the first to be erected in the United States, was laid on November 9, 1843, by John Quincy Adams, sixth president of the United States. The original telescope was for many years the largest in the United States and second in size only to an instrument in the Royal Imperial Observatory at Poulkova, Russia. This 11-inch glass is still in constant service.

Ormsby MacKnight Mitchel, professor of natural philosophy, mathematics and astronomy at Cincinnati College, forerunner of the University of Cincinnati, was the founder of the observatory, virtual builder of its original structure and purchaser of the telescope. Professor Mitchel quarried his own stone, dug his own sand, burned his own lime, dammed a small stream of water, supervised construction of the building and served without pay for two decades. Ground was donated by Nicholas Longworth, grandfather of the late Speaker of the House, Nicholas Longworth, a graduate of the university, on Mount Adams, a Cincinnati hill-top. The observatory was moved in 1873 to its present site on Mount Lookout, several miles farther from the downtown area.

Professor Mitchel was the first director, serving until the Civil War. In 1846 he began the publication of the monthly *Sidereal Messenger,* the first astronomical periodical in the United States. He was succeeded by Professor Cleveland Abbe, who inaugurated a system of telegraphic weather reports which aroused such interest that the U. S. Weather Bureau organized the same service on a nationwide scale.

Dr. Everett I. Yowell, director of the observatory from 1930 to 1940, is now acting in a temporary capacity until a successor to the late Dr. Elliott Smith is appointed. Dr. Smith died on September 29.

SCIENTIFIC NOTES AND NEWS

DR. RICHARD E. SHOPE, a member of the Rockefeller Institute for Medical Research, has been awarded the John Scott Medal, Certificate and Premium of $1,000 for his "discovery of the complex etiology of swine influenza."

AT the annual dinner in Chicago of the American Society for Metals on October 21 the medal of the society was presented to Roy A. Hunt, president of the Aluminum Company of America, Pittsburgh, in recognition of his leadership "in the research and technical development of a metal which has had its entire industrial growth in the past fifty-five years." By consistently sponsoring research and development, Mr. Hunt has helped substantially to advance the arts and sciences relating to metals. The gold medal of the society was presented to Dr. Zay Jeffries, technical director of the lamp department at Cleveland of the General Electric Company, in recognition of his "outstanding metallurgical knowledge and of his great versatility in the application of science to the metal industry."

PROFESSOR ARTHUR H. COMPTON, professor of physics at the University of Chicago, has been presented with the second annual award of the Jewish Education Committee as the "American who has made the most significant contribution to the promotion of human brotherhood." Dr. Compton has been co-chairman of the National Conference of Christians and Jews since 1938.

DR. ARTHUR C. BACHMEYER, director and associate dean of the division of biology of the University of Chicago Clinics, was presented on September 13 during a meeting of the association with the award of the American Hospital Association for meritorious service to the hospital field. According to the inscription on the medal, Dr. Bachmeyer was recognized as "a distinguished administrator and educator whose achievements have greatly advanced standards of treatment for patients and educational opportunities of lasting benefit to his fellow citizens."

DR. FRANK L. CAMPBELL, professor of zoology and entomology at the Ohio State University, was tendered a farewell party by the staff and graduate students of the department on the occasion of his resignation to become director of publications for the American Association for the Advancement of Science. Several gifts were presented to Dr. Campbell, including a bound volume of letters from his former students.

THE Institute of Medicine of Chicago announces that the Jessie Horton Koessler Fellowship for the aid of research in biochemistry, physiology, bacteriology or pathology, which carries a stipend of $500, has been awarded for 1943–44 to Maurice R. Hilleman, who will work with Dr. F. B. Gordon on the immunological relations of the psittacosis-like viruses in the Ricketts Laboratory of the University of Chicago.

DR. C. E. K. MEES, director of research and development of the Eastman Kodak Company, has been appointed Hitchcock lecturer at the University of California. He has chosen as the general subject of his lectures "Science and Evolution." They will be given on October 26 and 28 and on November 2, 4 and 9. The Hitchcock Foundation was established to provide free lectures on scientific and practical subjects, "but not for the advantage of any religious sect or upon any political subject."

OFFICERS elected to direct the American Dairy Science Association for 1944 are Arthur C. Ragsdale, professor of dairy husbandry at the University of Missouri, *Vice-president;* P. H. Tracy, professor of dairy manufactures at the University of Illinois, and C. L. Blackman, professor of dairy husbandry at the Ohio State University, *directors for three-year terms.* A. C. Dahlberg, Cornell University, advances automatically from vice-president to president. Robert B. Stoltz, professor of dairy technology at the Ohio State University, continues as secretary-treasurer, starting his ninth year in that post. Thomas S. Sutton, professor of animal husbandry at the Ohio State University, continues as editor of *The Journal of Dairy Science.* H. F. Davis, of the University of Nebraska, the retiring president, becomes a member of the board of directors. The association will hold a war conference at the Ohio State University on June 21, 22 and 23 in place of the annual meeting.

CAPTAIN C. RAYMOND WELLS, U. S. N., of Jamaica, L. I., chief of the dental division of the National Selective Service System, was installed on October 13 as president of the American Dental Association.

DR. DONALD DUNCAN, of the University of Texas, has been appointed professor of anatomy at the Louisiana State University. Dr. William Lane Williams, instructor in anatomy at the Yale University Medical School, has been appointed assistant professor of anatomy.

FREDERICK GARDNER CLAPP, of Bronxville, N. Y., consulting geologist, who was petroleum adviser to the Imperial Government of Iran in 1927–28 and again in 1933, has arrived in Ankara to become petroleum adviser to the Turkish Government.

R. C. BAINES, of Purdue University, plant pathologist, will conduct an emergency disease survey in

Illinois through an appropriation of special funds made by the U. S. Department of Agriculture. He is giving special attention during late September and October to sweet potato disease problems in southern Illinois, both in the field and in storage.

DR. D. A. SANDERS, veterinarian of the Florida Experiment Station at Gainesville, is now in the Bahama Islands, where he went to investigate diseases among Bahaman livestock and advise animal industry workers there on methods of their control. He was granted a short leave of absence at the request of the Agricultural and Marine Products Board of the Bahaman government.

PROFESSOR EDWARD HINDLE, regius professor of zoology at the University of Glasgow, has been appointed scientific director of the Zoological Society of London.

DR. RUSSELL M. WILDER has resigned as chief of the civilian food requirements branch of the Food Distribution Administration to return to his work at the Mayo Clinic, Rochester, Minn. He will continue to serve as medical adviser to the administration. Norman Leon Gold, Silver Spring, Md., who is assistant to the administrator of agricultural marketing administration, U. S. Department of Agriculture, has been made acting chief.

DR. CORNELIUS P. RHOADS, director of the Memorial Hospital for the Treatment of Cancer and Allied Diseases, New York City, has been granted leave of absence to become chief of the Medical Division of the Chemical Warfare Service of the U. S. Army, with the rank of Colonel.

DR. PAUL M. O'LEARY, deputy price administrator in charge of rationing, on leave of absence as professor of economics at Cornell University, has become head of the Washington staff of the Research Institute of America.

WALTER F. STRAUB, of Chicago, founder and president of the W. F. Straub Company, food products and pharmaceutical manufacturers, has been appointed director of the food-rationing division of the Office of Price Administration. He succeeds Harold B. Rowe, who has been transferred to the Office of Economic Warfare.

ACCORDING to an Associated Press dispatch, William S. Paley, president of the Columbia Broadcasting System, has accepted a special overseas assignment for a limited period from the Office of War Information. Mr. Paley will be associated with C. D. Jackson in the psychological division at General Eisenhower's headquarters.

DR. HAROLD G. WOLFF, associate professor of medicine of the Cornell University Medical College, on October 28 will deliver the first Harvey Society Lecture of the current series at the New York Academy of Medicine. The subject of the lecture will be "Some Observations on Pain."

THE Washington Academy of Sciences celebrated the Copernicus Quadricentennial on October 21 when Stephen P. Mizwa, secretary and executive director of the Kosciuszko Foundation and secretary of the National Copernican Quadricentennial Committee, gave an address entitled "Nicholas Copernicus."

DR. L. H. MACDANIELS, head of the department of horticulture of Cornell University, who was recently appointed administrator of the agricultural extension program of the Near East Foundation, gave on October 20 a lecture on "Horticulture's Present and Future Opportunities and Responsibilities" at the ninth annual meeting of the Long Island Horticultural Society.

DR. A. M. ADAMSON, professor of entomology at the Imperial College of Tropical Agriculture, Trinidad, recently addressed the seminar in zoology of the University of California at Berkeley. In addition to his work in zoology and instructing students in entomology, Professor Adamson is in charge of the plant quarantine station for the British West Indies, British Guiana and British Honduras.

THE fifty-fourth annual meeting of the Association of American Medical Colleges will be held under the presidency of Dr. Waller S. Leathers, dean of the School of Medicine of Vanderbilt University, at the Hotel Statler, Cleveland, from October 25 to 27.

A WINSLOW professorship in one of the sciences at Hamilton College has been made possible by a bequest of $150,000 from the estate of the Reverend Dr. William C. Winslow.

THE *Journal* of the American Medical Association states that the U. S. Public Health Service has made a grant to Washington University School of Medicine, St. Louis, to help to finance a cooperative study of the gross anatomy of the spinal dura mater and the conformation of the posterior surface of the sacrum. The project is under the supervision of Dr. Mildred Trotter and Dr. Virginia S. Lanier, of the department of anatomy, and Dr. Howard E. McKnight, of the department of obstetrics and gynecology. It is anticipated that the results will be a contribution to the procedure of the administration of continuous caudal anesthesia in childbirth.

ACCORDING to the *Journal* of the American Medical Association, the New York Academy of Medicine has announced that the Louis Livingston Seaman Fund of $1,000 is now available. Applications will be received either from institutions or from individuals up to

November 1. The fund will be expended only in grants in aid for investigation or scholarships for research in bacteriology or sanitary science and may be made for securing technical help, aid in publishing original work and the purchase of necessary books or apparatus. Additional information may be obtained from Dr. Wilson G. Smillie, chairman of the fund, 1300 York Avenue, New York City.

PROFESSOR LEONARD WING, of the department of zoology of the State College of Washington, Pullman, has received a special grant for the study of the biology of human population. The work will be based on data of 15,000 Quaker families from the monthly meeting records, beginning in 1650. The records have been made available for study by Dr. W. W. Hinshaw, Washington, D. C. The project parallels a study of animal population made by Professor Wing which is now nearing completion.

THE daily press reports that Bernard M. Baruch plans to establish an institution for the study and teaching of physiotherapy. He has appointed a committee of specialists, with Dr. Ray Lyman Wilbur, chancellor of Stanford University, as chairman, to survey the field and advise with him on the project. The establishment of a school to select the best from the various phases of physiotherapy was suggested to him by Dr. Walter Belknap Jones, who was for many years an associate on the faculty of the College of Physicians and Surgeons of Columbia University. Serving on the committee with Dr. Wilbur will be Dr. W. T. Sanger, president of the Medical College of Virginia; Lieutenant-Colonel Benjamin A. Strickland, Jr., Army Medical Corps; Dr. Charles F. Behrens, head of the x-ray department at the Naval Medical Center, Bethesda, Md.; Dr. Carl R. Comstock, of Saratoga Springs, N. Y.; Dr. John Coulter, medical director of the School of Physical Therapy, Northwestern University; Dr. Kristin G. Hansson, medical director of the School of Physical Therapy at the Hospital for Special Surgery, New York City, and Dr. Frank Krusen, medical director of the Mayo Clinic and School of Therapy, Rochester, Minn. The committee will have $25,000 at its disposal for this study. Whether the institution to be founded should be an entirely new organization or one established in conjunction with an existing institution is one of the matters to be decided by the group.

THE Dominion Government has, according to the Ottawa correspondent of *The Times*, London, approved expenditure for the establishment of plants and equipment in Montreal and Toronto for the production of penicillin. An appropriation has been made to cover the cost of establishing the industry and of the production of the first 26,000,000,000 units of penicillin for use by the Canadian armed forces. This constitutes the largest single order for medical supplies which has so far been placed by the Department of Munitions Supply. According to C. D. Howe, the Minister of Munitions, the new industry will employ 250 men and women, and will come into operation next February; by the middle of April it will be producing a weekly average of 500,000,000 units of penicillin.

THE Soviet Academy of Sciences recently sent an expedition headed by Professor Alikhanyan, a Stalin prize winner, to the summit of Mount Ararat to study cosmic rays. The group spent several weeks on Mount Ararat last year and collected valuable data on cosmic rays. These materials were the subject of study during the winter by experts of the Physico-Technical Institute of the Academy of Sciences. It is reported that in the composition of the cosmic rays a considerable quantity of proteins, nuclei of hydrogen atoms, were discovered, the exact nature of which has not yet been investigated. The further examination of this question is one of the most important tasks of the present expedition.

DISCUSSION

ELEMENTS OF THE GENERALITY OF THE GROUP CONCEPT

ONE of the most instructive brief statements relating to group theory is that the first four fundamental operations of arithmetic, *viz.*, addition, subtraction, multiplication and division, are combined into one operation in group theory. This one was at first usually called multiplication, but in the recent literature it is also frequently called addition. It represents the combination of the elements of a group in pairs so as to obtain a single element of the group for each such pair and it is commonly denoted by the same symbol as is used for the corresponding operation in arithmetic. The possibility of combining the said four fundamental operations of arithmetic into one in group theory suggests that the concept of group is more general than the concept of number, notwithstanding the fundamental importance of number in the development of mathematics throughout the entire period of this development up to the present time.

The fact that the group concept is more general than the number concept is also suggested by the use

of numbers for the elements of a group in special categories of groups. Moreover, the definitions of abstract groups have always been so formulated that our ordinary numbers are included among the possible elements which may be involved in these groups. In particular, these numbers obey the associative law when they are combined either by addition or by multiplication, and this law has usually been assumed either explicitly or implicitly in the definitions of an abstract group. It is a fundamental fact in the history of mathematics that this law did not receive a special name in the mathematical literature until about the middle of the nineteenth century when it was thus named by the Irish mathematician, W. R. Hamilton (1805–1865), the first two volumes of whose "Mathematical Papers" were published by the Royal Irish Academy in 1931 and 1940, respectively.

Since substraction is the inverse of addition and division is the inverse of multiplication two of the said four fundamental operations of arithmetic disappear if an operation and its inverse are regarded as belonging to the same more general operation and these four operations thus become only two fundamental operations of arithmetic. The fact that the subtraction of a positive number is equivalent to the addition of the corresponding negative number was noted in the *Arithmetica integra* by M. Stifel (1544), who used these numbers just as we do now, without, however, giving a satisfactory theory for this use. On the other hand, the ancient Babylonians already regarded the division by positive integers as the multiplication of the dividend by the inverse of the divisor and constructed extensive tables of the inverses of integers. Nothwithstanding the fact that the use of negative numbers and common fractions theoretically reduced the said four fundamental operations to two such operations, mathematicians usually continued to speak of them as four operations even in algebra where the use of negative quantities is commonly considered from the beginning of the subject in our schools.

It has frequently been emphasized that in group theory the elements are usually undefined and only the laws of the combinations of these elements are considered, but it is not so commonly noted that in arithmetic the numbers employed are also usually undefined. Efforts to define the term number have been made in many instances, but it is questionable whether any of them have been actually successful. Such statements as that number is the property of a set of individuals which is independent of the nature of these individuals and is common to all sets of individuals which can be placed in a (\| , \|) correspondence are in reality not a definition of the term positive integer, but merely a statement of some of the assumed properties of such integers. It is, however, true that for thousands of years it has been found convenient to combine positive integers in pairs so as to obtain other such integers, according to two fundamental laws of combination called addition and multiplication while the elements of a group are combined according to only one such law. This is further evidence of the fact that the group concept is more general than the number concept.

This greater generality of the group concept, while the number concept has been the more important of the two in the development of mathematics, emphasizes the need of distinguishing between generality and importance in mathematical theories. It also tends to explain why the group concept received growing attention in the latter half of the nineteenth century and the early part of the present century, for it was then when generality received growing attention on the part of mathematicians. It is only natural that there are occasional reactions with respect to recent increased emphasis and some of the current mathematical writings exhibit evidences of such reactions,[1] but growing generality can be observed throughout the entire history of mathematical developments, and these temporary reactions should not seriously disturb the modern students of our subject, who realize that it is not free from changing fashions even if it has always made a relatively strong appeal to the male members of society.

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UNIVERSITY OF ILLINOIS

PROTEIN CONCENTRATES FROM GRASSES

THERE is at present a marked shortage of concentrates high in protein value available for consumption by farm animals. One of the most abundant sources of protein is grass, only part of which is used for pasture, hay or silage. If the remainder could be converted economically into a concentrated non-perishable form of protein it might be valuable in relieving the present shortage of protein concentrates.

Methods of extracting protein from biological substances may be found in the literature, but to the author's knowledge none has been made use of in preparing proteins from forage crops on a large scale. The author has made a number of preparations on a laboratory scale and the details will be published elsewhere. An example is given here.

Dried ground grass was extracted overnight at room temperature with 0.25 normal sodium hydroxide and then filtered through cheesecloth. The filtrate was brought to pH 3.6 with hydrochloric acid and a pre-

[1] For instance, on page 168 of "What is Mathematics?" by Richard Courant and Herbert Robbins (1941), it is asserted that "in geometry, perhaps, the importance of the group concept has been a little exaggerated."

cipitate was filtered off, dried and ground. The precipitate, dark green in color and with a grassy flavor, contained 58 per cent. protein on the dry basis, 6 per cent. ash and less than 1 per cent. of lignin and cellulose. It also contained 440 p.p.m. of crude carotene, but this amount decreased during laboratory storage. Based on a ton of dry grass the yield of this substance was about 285 pounds. The grass residue, yielding about 875 pounds per ton and still containing 44 per cent. of the original protein, appeared to be a fair quality stock feed.

Extraction of the protein concentrate with 95 per cent. alcohol removed about 20 per cent. of its dry weight but only 4 per cent. of its total nitrogen. This final product was dark in color and tasteless and contained over 72 per cent. protein on the dry basis. Its calculated yield per ton was 220 pounds.

It is suggested that either the crude or the extracted product could be made from surplus forage, or forage otherwise wasted, and if economically produced should be useful in supplementing present stocks of protein concentrates, particularly for poultry and hog rations.

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WHY THE KILGORE BILL?

THERE are probably few leading men in science who would not, with minor qualifications, agree with the five major objectives set forth by Senator Kilgore in his article in SCIENCE of August 13, discussing "The Science Mobilization Bill." These may be abbreviated to read as follows:

(1) The need for a central independent agency of the Government devoted exclusively to the progress of expansion in Science and Technology.

(2) The need for integration of existing Government research and development facilities.

(3) The need for active Governmental support of fundamental research.

(4) The need for a uniform and effective policy to achieve the fullest utilization of scientific and technical manpower in wartime.

(5) The need to promote the use of Government patents in the interest of the public.

It is probably on the basis of such desirable objectives that Senator Kilgore, in his introductory paragraphs, ventures the rather broad statement "that the men of science favor the bill" (S. 702). From the discussions and comments that have come to my attention since the publication of my contribution to this discussion in SCIENCE of June 4, a large majority of the leading scientific men consulted have expressed strong opposition to the passing of S. 702. Unfortunately, a few have expressed violent opposition with words not always scientifically chosen. Unquestionably, however, all these men would find no contention over the objectives to be gained in the abbreviated statements quoted above. It is increasingly clear that a desirable objective is one thing and the method of obtaining such an objective is quite a different thing. It is not primarily a question of whether the ends justify the means but rather a question of whether the ends could be attained by the means proposed. This appears to be the basis and the only basis for a sound and intelligent discussion of the Mobilization of Science Bill.

No scientist can but be gratified as to the Senator's statement, "I have long realized the basic importance to the welfare of the country of a free science and an expanding technology." Perhaps Senator Kilgore over-compliments the scientist when he states that "Scientific and technical men hold in their heads and hands the collective knowledge of the ages." The free and copious publication in technical literature of the results of basic research in every conceivable branch of science shows the eagerness on the part of a scientific worker to give to the public the benefit of his findings and thus would appear to provide an adequate answer to the Senator's question, "Whose knowledge is it?"

It becomes obvious from a careful study of the Bill S. 702 that the proposed legislation would attempt to make impossible the repetition of certain unfortunate uses of technical knowledge by "vested" and "selfish interests." Such a problem is not specifically a problem of science and technology but a problem of society. As long as human nature is what it is, the scientific approach must take into consideration "selfish interests" as a specific entity in human behavior inherited through evolutionary processes as a means for the preservation of the individual and the species. The study of "selfish interests" presents a problem in social welfare that should be approached with the same order of scientific intelligence as one approaches the problems of instability in gravimetry or geomagnetism. Such can not be dismissed by legislation, nor does it appear certain that its dismissal would bring about an unmitigated Utopia in science.

No one proposes that rugged individualism should be fostered at the expense of public welfare. "Selfish interests" gaining the seat of authority have brought ruin to the Axis countries. It is, I think, the danger of the creating of an opportunity for "selfish interests" in high places that has caused the apprehension among those scientists who have expressed opposition to the Kilgore Bill. When we are willing to recognize that "selfish interests," however undesirable, is a potential entity that must be considered and accepted as a scientific fact, the question raised by the Mobilization of Science Bill resolves itself into the relative

dangers of distributed control as against centralized control, of cooperative arrangements against an attempted compulsion. It is because of the unlimited powers of the centralized control proposed in the Kilgore Bill, irrespective of the details of its sections, that so clearly defines the issue.

Reviewing the five objectives of the Senator's article in SCIENCE, there appears to be no valid reason why an already existing independent scientific agency of the Government, namely, the National Research Council, can not or could not bring about the objectives for which the Kilgore Bill was proposed. The Executive Order of President Wilson creating the National Research Council on May 11, 1918, so specifically directs. At the risk of repetition, and for the purposes of comparison with Senator Kilgore's five objectives, we quote:

The duties of which [the National Research Council] shall be as follows:

(1) In general, to stimulate research in the mathematical, physical and biological sciences, and in the application of these sciences to engineering, agriculture, medicine and other useful arts, with the object of increasing knowledge, of strengthening the national defense, and of contributing in other ways to the public welfare.

(2) To survey the larger possibilities of science, to formulate comprehensive projects of research and to develop effective means of utilizing the scientific and technical resources of the country for dealing with these projects.

(3) To promote cooperation in research, at home and abroad, in order to secure concentration of effort, minimize duplication and stimulate progress; but in all cooperative undertakings to give encouragement to individual initiative, as fundamentally important to the advancement of science.

(4) To serve as a means of bringing American and foreign investigators into active cooperation with the scientific and technical services of the War and Navy Departments and with those of the civil branches of the Government.

(5) To direct the attention of scientific and technical investigators to the present importance of military and industrial problems in connection with the war, and to aid in the solution of these problems by organizing specific researches.

(6) To gather and collate scientific and technical information, at home and abroad, in cooperation with governmental and other agencies, and to render such information available to duly accredited persons.

One can not review the history of the establishment of the National Research Council and escape the conclusion that the intent of such an agency was to accomplish the very purposes for which presumably the Kilgore Bill originated, but purposely avoiding the objectionable defects which are so flagrant to those who have opposed the proposed legislation in S. 702.

Until, therefore, the National Research Council is proved to be ineffective and void of any means of making itself so, the wisdom for further congressional acts for such a purpose will remain open to question. Were the Kilgore Bill to be passed as is, the only amendment that would appear to be consistent with such action would seem to require that with the passage of this act the National Research Council and possibly even the National Academy of Sciences should thereupon become dissolved. In times of such national emergency as confronted President Wilson and President Lincoln, one has difficulty in believing that it was the intent that these institutions were to be perpetuated primarily for honoring distinguished scholars with membership, however creditably such honor could be bestowed. In conclusion, why the Kilgore Bill?

HARLAN T. STETSON

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SCIENTIFIC BOOKS

CYTOLOGY

Fundamentals of Cytology. By LESTER W. SHARP. 267 pages. 6×9. 176 illustrations. New York: McGraw-Hill Book Company, Inc. $3.00.

PROFESSOR SHARP, whose "Introduction to Cytology" received a deservedly warm welcome (there were three editions between 1921 and 1935), has in the present book essayed to bring the subject to the level of the college student who has only an elementary course in botany and zoology as a background. Sharp is exceptionally skilful in presenting and clarifying complex issues and if any one is equal to the task, it is he. That he has not been completely successful in his attempt is due to the fact that in the present state of confusion and clash of opinions some aspects of cytology can not possibly be given a portrayal that is both elementary and fair. The book comprises six chapters devoted to more general aspects and to the extranuclear elements of the cell, and eleven on the cytology of reproduction and genetics. This is a distribution that well reflects the status of our information concerning the cytoplasm and cytogenetics, respectively, especially if cellular physiology be not stressed.

In the chapters on the cytoplasmic components of the cell there is a great volume of information and, indeed, the treatment is often more like a condensation than a simplification. The instances where Sharp has attempted the latter, as in the case of chondriosomes

and Golgi material, are not always entirely successful, but in the present state of confusion of those particular subjects that is hardly to be wondered at.

The difficulty is at least as great in dealing with cytology in its bearing on genetics. In some aspects, as in the chromosomal variations of structure and number and of hybridity, the book is concerned with aspects which for the present are generally accepted. In presenting them to the student, Sharp is at his best. But in the basic mechanisms that underlie chromosomal behavior, the difficulties of elementary presentation become almost insurmountable. To be sure, by soft-pedaling and ignoring the dubious parts of the evidence, these sections could be written so as to give a logical and well-rounded account. Many geneticists conceive of the cytological background in this way, and several books on genetics and cytology have so treated it. Generally, Sharp, too, sketches his preliminary outlines in this fashion, but he is too good a cytologist to let his case rest on such a treatment and thus often follows it up with the doubts and faults that lurk behind the beautiful story. The chapter on chromosomes is an illustration of this and though to a working cytologist it seems like an excellent, brief survey, one wonders what an elementary student's attitude may be about the number of chromonemata, coiling, heteropycnosis and salivary chromosomes, when he gets through with it. It is for this reason that it is to be regretted that Sharp did not expand the conclusions which terminate about half of the chapters, for it is there that his skill in outlining basic concepts is especially evident.

The criticism sometimes made of Sharp's earlier book that zoological cytology does not meet with as adequate consideration as botanical cytology, will likely be made here also. In a way, the illustrations reflect this unequal distribution, for there are 115 figures of botanical against 54 figures of purely zoological subjects. But aside from the fact that Sharp is himself primarily a botanist and quite naturally more at home in his side of the field, it might be pointed out that especially in the cytogenetics of the last ten years the animal cytologist has definitely fallen behind his botanical colleague in furnishing the evidence that is advancing our knowledge. However, this does not altogether explain the somewhat uneven judgment employed in listing reference works to animal cytology. Thus the chapter on animal reproduction, perhaps the weakest in the book, is supported by twelve references. Of these, six are on protozoa, and though this group has admittedly been somewhat neglected by both zoologists and botanists, that seems a little disproportionate. Of the remaining six references, Hegner's 1914 book certainly does not meet the demands of 1943, and Agar's and Doncaster's treatises, both published twenty-three years ago, can hardly be expected to give an adequate survey of the modern status of the subject.

As already indicated, many aspects of cytology are at present in that state of flux which betokens progress. This renders it almost impossible to reduce it to simple outlines and by the same token makes it very difficult to present it justly to a student with only an elementary background. If the attempt is nevertheless to be made, Sharp's book will prove of great help.

FRANZ SCHRADER

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QUANTITATIVE ANALYSIS

Elementary Quantitative Analysis. By CARL J. ENGELDER. Third edition. viii + 283 pp. 15 × 23 cm. New York: John Wiley and Sons, Inc. 1943. $2.75.

THIS book is designed for a short course in quantitative analysis. It is divided into four sections: "Fundamental Principles of Quantitative Analysis"; "Volumetric Analysis"; "Gravimetric Analysis"; and "Systematic Quantitative Analysis."

The section on fundamental principles introduces the student to the subject and includes discussions of the scope and theoretical basis of quantitative analysis, preparation of sample, mathematical operations, errors and precision, reagents and the analytical balance. This entire series of discussions occupies less than twenty-six pages.

The section on volumetric analysis includes a chapter on theory, apparatus, technique and calculations, and chapters on neutralization methods, redox methods and volumetric precipitation methods. Both the normality and the titer methods of expressing solution strength are discussed with emphasis on the latter method. The chapter on neutralization methods includes the preparation of standard acid and alkali, using sodium carbonate as the primary standard; the determination of sodium carbonate in soda ash, the strength of potassium acid phthalate solution and the strength of oxalic acid solution; and the theory of hydrolysis, indicators and differential titrations. No mention is made of the removal of carbonate from standard alkali. The redox chapter includes experiments with permanganate, iodine, dichromate and ceric sulfate. The precipitation methods include the determination of chloride, silver thiocyanate and cyanide. Throughout the section, the author encourages the use of two burettes with a resultant jockeying back and forth in finding end points.

The section on gravimetric analysis gives procedures for chloride, iron, sulfate, calcium, magnesium and phosphate. The theory of gravimetric precipita-

tion and purification of precipitates is almost totally neglected.

The section on systematic analysis includes general information which should be useful for reference purposes.

There are a number of aids for the student and the instructor: question and problem sets following each chapter; a plan of the course; and an appendix containing sample report forms, a division on the literature of analytical chemistry, a division on reagents and supplies, density tables, gravimetric factors and a table of five-place logarithms.

The experiments are well chosen and conveniently arranged, if a bit old-fashioned, but the book suffers from an attempt to cover too much ground in too short a space with a resultant dearth of specific information. However, the material included could serve as good basis for a course in quantitative analysis if properly expanded in the accompanying lectures.

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THE CHEMICAL FORMULARY

The Chemical Formulary. Vol. VI. By H. BENNETT, editor-in-chief. xx + 636 pp. Brooklyn, N. Y.: Chemical Publishing Company, Inc. 1943. $6.00.

THIS is the sixth volume of the series, and as in previous volumes the editor-in-chief has had the assistance of an editorial board of about fifty specialists in industrial and educational organizations. A footnote to the preface states that all the formulae in volumes I to VI are different except for a few typical cases used in the introduction to illustrate directions and advice for new users of the volumes.

The fields covered in the present volume include Adhesives, Beverages, Emulsions, Inks, Paints and Varnishes, Paper, Pyrotechnics and Explosives, Rubber, Plastics, Detergents, Textiles, etc. A timely section is included on special formulae of military interest.

Another section which may be of value to many users is devoted to substitutes for scarce or priority materials. A perusal of this section would seem to indicate that many of the suggested substitutes would be far from universally adaptable but might be useful for certain specific applications.

A directory of sources of chemicals and supplies is included. This will prove of value to users of the volume, since many of the substances mentioned in formulae throughout the book are trade-marked or copyrighted "trade names" and could not be secured on the open market either by reason of their compound nature or secret composition. The editor feels justified in including such substances, since without them many ideas and processes offered in formulae of specialty producers would have been automatically eliminated.

Tables of weights and measures, a list of foreign sources of chemicals and an index of some 2,400 entries complete the present volume. Previous volumes have been widely reviewed in technical and trade publications such as *American Dyestuffs Reporter, Electrochemical Society Bulletin, Modern Plastics, Rubber Age,* etc., and have received most generous and favorable comment. The present volume is a worthy addition to the series and will doubtless find wide acceptance among chemists and technologists throughout the industry.

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SPECIAL ARTICLES

INFLUENCE OF ADRENAL CORTICAL SECRETION ON BLOOD ELEMENTS[1]

THE marked decrease of lymphoid tissue produced by augmented adrenal cortical secretion[2] has led to an examination of the changes in blood elements resulting from adrenal cortical stimulation. The availability of purified pituitary adrenotropic hormone,[3] the normal physiological regulator of adrenal cortical activity, makes possible the study of fundamental phenomena resulting from adrenal cortical secretion. The establishment of these data should be of significance in the elucidation of changes following stimulation of the adrenal cortex by a variety of agents.

It is the purpose of this communication to indicate the striking alterations in blood elements which result in normal, approximately fifty-day old, mice of both sexes (CBA strain, Strong) within a few hours following a single subcutaneous injection of pituitary adrenotropic hormone (1.0 mg in 0.5 ml solution). Blood analyses have been conducted at intervals after hormone injection, using groups of mice at each time interval, rather than successive determinations on the same animals. The blood picture observed is characterized by the following: (a) decrease in total leucocyte count, (b) decrease in absolute number of lymphocytes, and (c) increase in absolute number of

[1] This investigation has been aided by grants from the International Cancer Research Foundation, the Fluid Research Fund, Yale University School of Medicine and the Committee on Therapeutic Research, Council on Pharmacy and Chemistry, American Medical Association.

[2] T. F. Dougherty and A. White, *Proc. Soc. Exp. Biol. Med.*, 53: 132, 1943.

[3] G. Sayers, A. White and C. N. H. Long, *Proc. Soc. Exp. Biol. Med.*, 52: 199, 1943.

polymorphonuclear cells. These alterations in the leucocyte elements are evident three hours following hormone injection, and the maximum effect, which is characterized by an extreme lymphopenia, is observed at nine hours after injection. Shortly thereafter the leucocyte picture tends to return to normal. These changes are depicted in Fig. 1.

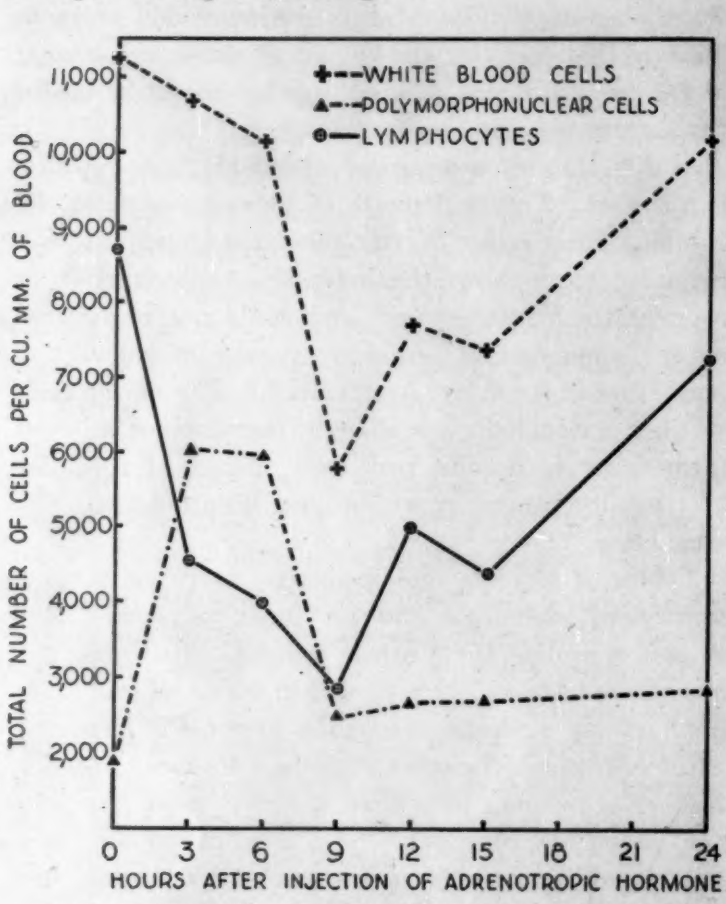

FIG. 1. Alterations produced in the total leucocyte, lymphocyte and polymorphonuclear blood counts of normal mice receiving, at zero time, a single, subcutaneous injection of 1.0 mg of pituitary adrenotropic hormone. The points on each curve at 3, 6, 9, 12, 15 and 24 hours after hormone injection are, respectively, the averages of data for groups of 5, 5, 7, 6, 7 and 5 animals. A total of 35 animals were employed.

An initial increase in hemoglobin and red blood cell count was generally observed within three to six hours after a single injection of adrenotropic hormone. This effect, however, did not persist in other animals injected daily with the hormone. The increase in hemoglobin concentration was not due to hemoconcentration.

In order to determine whether the change in leucocyte picture might be due to a non-specific protein effect, mice of the same age and strain were injected with 2 mg of prolactin[4] and blood determinations made on animals sacrificed at 3-, 6- and 9-hour intervals following the hormone administration. Other mice received subcutaneously 2 mg of serum gamma globulin (human) or one unit of posterior pituitary pressor principle (Parke-Davis). Injection of prolactin or pitressin produced an initial increase of polymorphonuclears, but no significant decrease in total leucocytes or lymphocytes. In contrast to the adrenotropic hormone injected animals which showed the maximum alteration in blood picture (lymphopenia) nine hours after hormone injection, mice given prolactin or pitressin had a normal leucocyte count at this time. Serum globulin injection produced no alteration in blood leucocytes. This would suggest that the results with prolactin are not attributable to a non-specific protein effect, but are likely the result of contamination of the prolactin preparation with posterior lobe principle.[5] The latter may initially stimulate the adrenal cortex.

Evidence that the effect of adrenotropic hormone on the leucocyte picture is mediated through the adrenal cortex is seen from the following summary of other experimental results which have been obtained:

(1) The injection of adrenotropic hormone, prolactin or pitressin into adrenalectomized mice does not produce a decrease in total leucocyte or lymphocyte counts.

(2) The injection of 0.5 ml of adrenal cortical extract (Wilson) in normal and in adrenalectomized mice produces a fall in total leucocytes, an absolute lymphopenia and an absolute polymorphonuclear leucocytosis. The blood changes produced by adrenal cortical extract administration in both normal and adrenalectomized mice are identical in degree with those occurring after adrenotropic hormone injection (Fig. 1). However, the time relationships are somewhat different in that the maximum leucocyte changes in mice given cortical extract occur at an earlier time.

Changes in the blood elements, identical with those presented in Fig. 1, have been observed in 250 to 300 gram male rats (Sprague-Dawley strain) given single injections of either 5 mg of adrenotropic hormone or 5 ml of adrenal cortical extract (Upjohn).[6]

A group of 25 mice were given daily injections of 1 mg of adrenotropic hormone for 15 days and blood determinations made on groups of 5 animals at 3-day intervals. Throughout the entire injection period, the animals did not show consistent changes in total leucocyte count, but exhibited an absolute lymphopenia and an absolute polymorphonuclear leucocytosis. Similar groups of mice injected chronically with 2 mg of prolactin each day showed a normal blood picture throughout the experimental period.

[4] A. White, R. W. Bonsnes and C. N. H. Long, *Jour. Biol. Chem.*, 143: 447, 1942.

[5] Assay of the prolactin preparation used showed it to have a pressor activity (cat) equivalent to 0.6 unit pitressin (Parke-Davis) per mg.

[6] The experiments in rats have been conducted in collaboration with Mr. C. U. Lowe.

The day-to-day constancy of the increase in polymorphonuclear leucocytes and the decrease in lymphocytes in animals injected daily with adrenotropic hormore and the lack of any leucocyte changes in prolactin treated animals emphasize the significance of the adrenal cortex in the phenomena which are being reported.

The changes which have been observed in the leucocyte picture following adrenotropic hormone injection are essentially those which have been described for a variety of circumstances, some of which may now be directly attributed to adrenal cortical stimulation. For example, inanition stimulates adrenal cortical activity and produces a similar leucocyte picture.[7] It is not unlikely that other agents and experimental procedures which affect the adrenal cortex, and lymphoid tissue, are accompanied by these leucocyte changes. These possibilities are being subjected to experimental study.

The experiments summarized here will be published in detail elsewhere.

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THE NATURAL OCCURRENCE OF RIBOFLAVIN DEFICIENCY IN THE EYES OF DOGS[1]

OBSERVATION of malnourished persons for thirteen years has convinced me that the natural development of dietary deficiency diseases is slow; the onset insidious and difficult to recognize. Long before the nutritive failure can be diagnosed as pellagra, beriberi, scurvy, riboflavin deficiency or some one clear-cut syndrome, the afflicted persons have had months or years of ill health. Often they are unbelievably weak, listless and able to do little if any work. In the carefully selected case, the rapid improvement following intensive and persistent nutritive therapy leaves no doubt that the tissues function at a higher level soon after the missing substances are provided in sufficient amounts. Although the whole matter is very complex, comprehensive study over a period of several years has given us some valuable information. Since members of a family living together tend to eat a similar diet, we have adopted the policy of studying the entire family. That is to say, whenever a diagnosis of deficiency disease is made, we extend our studies to include the family. All members of the family are asked to report to the clinic for observation. Dietary surveys on the patient and on each member of his family are made by frequently visiting the homes. During such visits, we have observed that the family pets often appear emaciated and weak. Realizing that these animals usually subsist on scraps from the family table, it was natural for us to think that they, too, might have nutritional deficiencies. Examination of the dogs showed that black-tongue was not uncommon. (This spontaneous canine black-tongue responds as quickly to nicotinic acid as does pellagra in human beings.) Still more recently we have observed eye symptoms in dogs which appear similar to the ocular lesions of riboflavin deficiency in persons. These lesions respond as dramatically to riboflavin therapy as do those in human beings.

This communication is concerned primarily with such lesions in the eyes of four dogs belonging to families on which we were making laboratory and clinical studies. As these findings give an idea of the far-reaching effect of inadequate nutrition they seem worthy of separate publication at this time.

The dogs were emaciated, weak, sluggish, apathetic and held their heads much lower than the rest of their bodies. They refused food and all efforts to coax them to eat were without avail. Each dog had diarrhea characterized by frequently watery, foul-smelling stools. Saliva drooled continuously from their mouths. Examination of the mouth revealed the oral mucous membrane lesions characteristic of black-tongue.[2] While examining these animals lacrimation was observed. Even the light from a small flashlight in their eyes enlisted photophobia. In general the eyes appeared similar to those of persons with riboflavin deficiency which I have described,[3,4] and this suggested to me that these dogs had not only black-tongue, but riboflavin deficiency as well. A careful examination of their eyes showed pronounced injection of the sclerae and conjunctiva of both eyes. The vessels were unusually dilated and tortuous. There was a suggestion of rotary nystagmus. The animals did not keep their eyes still enough to carry out satisfactory slit lamp examinations. However, clinically the process appears similar to that in human beings, although in each of these dogs it was more extensive than I usually have seen in persons.

[7] C. F. Shukers and P. L. Day, *Jour. Nutrition*, 25: 511, 1943.

[8] Fellow of the International Cancer Research Foundation.

[1] University of Cincinnati Studies in Nutrition at the Hillman Hospital, Birmingham, Alabama. From the Department of Internal Medicine, University of Cincinnati. The expenses of this study were defrayed by funds given by the Nutrition Foundation for the study of earlier methods of diagnosing deficiency states and by the Abbott Laboratories.

[2] Garfield G. Duncan, "Diseases of Metabolism," 489 pp. Philadelphia: W. B. Saunders Company. 1942.

[3] Tom D. Spies, William B. Bean and William F. Ashe, *Annals of Int. Med.*, 12: 1830–1844, May, 1939.

[4] H. D. Kruse, V. P. Sydenstricker, W. H. Sebrell and H. M. Cleckley, *Public Health Reports*, 55: 157–169, January 26, 1940.

The photophobia was so severe and it was so difficult to keep the eyes still that satisfactory colored photographs were obtained only after numerous trials and errors.

A brief case report follows:

It is common knowledge that dogs with severe black-tongue are likely to die suddenly and since we have been able to relieve animals with spontaneous black-tongue,[2] we injected 150 mgs of nicotinic amide as soon as the dog had been carefully examined and illustrations made. Twenty hours later the dog showed remarkable improvement. He was obviously much stronger and ate the food offered. The fiery redness of the oral mucous membranes had faded considerably. Salivation had decreased and the diarrhea had stopped. The appearance of the eyes, however, remained unchanged. Next, 50 mgs riboflavin[5] were injected intravenously. Twenty-four hours later there was less lacrimation and photophobia. The injection had receded and there were fewer dilated and tortuous vessels in the conjunctiva and sclerae. Nystagmus was not present. Seventy-two hours later there was no detectable lacrimation or photophobia, and the redness and general increase in vascularity had subsided. Indeed, only very careful examination revealed "ghost vessels"—vessels which had been engorged but were now only faintly discernible.

Summary

In four dogs, the diarrhea, increased salivation and mucous membrane lesions characteristic of black-tongue were relieved within 24 hours following the administration of 150 mgs nicotinic amide, whereas the lacrimation, photophobia and extreme injection of the eye vessels did not diminish. These severe eye lesions regressed greatly 24 hours after the injection of 50 mgs of riboflavin, and in 72 hours had disappeared.

The simultaneous occurrence of nicotinic acid and riboflavin deficiency in four dogs is evidence that such deficiencies occur as mixed diseases rather than as single entities.

These findings are further evidence of the universality of nutritional deficiencies, since they suggest that deficiency diseases among the pets of families with deficiency diseases are not uncommon. In at least one instance the finding of nutritional deficiencies in a dog eating scraps from the family table led to a better understanding of the ill health of the family, none of whom had diagnostic lesions of deficiency disease at the time, although they all complained of weakness, nervousness, irritability and loss of appetite—the vague and ill-defined symptoms characteristic of deficiency diseases in the early stages.

TOM D. SPIES

[5] A special concentrated product sent to me for experimental trial by Hoffmann-La Roche, Inc.

[1] From the Department of Preventive Medicine, Harvard Medical School and House of the Good Samaritan, Boston, Mass.

[2] T. N. Harris, *Jour. Bact.*, 43: 739, 1942.

[3] H. J. Parish and C. C. Okell, *Jour. Path. and Bact.*, 33: 527, 1930.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

IDENTITY OF A LETHAL AGENT IN BROTH FILTRATES OF HEMOLYTIC STREPTOCOCCI WITH ERYTHROGENIC TOXIN[1]

THE similarity of a recently described lethal agent produced in broth cultures by hemolytic streptococci (Lancefield Group A)[2] to erythrogenic toxin raises the question of their differentiation.

Marked differences in heat stability indicate the existence of at least two kinds of hemolytic streptococcus toxin: the heat stabile erythrogenic and the heat labile hemolytic toxins. The resistance of eyrthrogenic toxin to comparatively high temperatures for considerable periods of time is well established.[3, 4] Since the lethal agent described, which was resistant to temperatures which do not completely inactivate erythrogenic toxin, and was lethal for mice, the effect of intravenous injection of heated and unheated erythrogenic toxin in mice was studied.

The toxins used were unpurified filtrates. Skin test doses per milliliter were determined by toxin-antitoxin flocculation. Table 1 summarizes the results obtained in mice by the intravenous injection of unheated toxins. Table 2 summarizes the results obtained with heated toxins and toxin-antitoxin mixtures. Toxin-antitoxin neutralization with heated and unheated toxins was checked by the intracutaneous rabbit test described by Fraser and Plummer.[5]

TABLE 1

DETERMINATION OF M. L. D. OF EROTHROGENIC TOXIN: INTRAVENOUS INJECTION IN MICE

Toxin	Dose (ml)	Skin test doses ×100	Result
Streptococcus NY 5 (Type 10)	1.0	300	+
	0.5	150	+
	0.25	75	−
Streptococcus BFO (Type 2)	1.0	300	+
	0.5	150	+
	0.25	75	−

(+) = death within 10 min.
(−) = no reaction.
Undiluted toxin contained approximately 2,000,000 skin test doses per ml. Toxins diluted 1:66 contain approximately 30,000 skin test doses per ml.
Mice 20–25 g in weight used.

[4] G. A. H. Buttle and A. S. R. Lowdon, *Jour. Path. and Bact.*, 41: 107, 1935.

[5] F. H. Fraser and H. Plummer, *Brit. Jour. Exp. Path.*, 11: 291, 1930.

Inspection of the tables shows that the intravenous administration of 15,000 S.T.D. produces a rapidly fatal result in mice. Temperatures as high as 100° C. for short periods of time do not completely inactivate erythrogenic toxin as evidenced by the fatal result following intravenous administration of larger doses of such heated filtrates (Table 2).

Thus, the characteristics described for the agent in broth filtrates of hemolytic streptococci are not distinguishable from those of erythrogenic toxin with respect to heat stabiiity and lethal action in mice. Furthermore, neutralization by erythrogenic anti-toxin completely obliterates the lethal action of broth filtrates of hemolytic streptococci in mice. For these reasons, unless it is shown that the lethal agent described remains in broth cultures after absorption of erythrogenic toxin with antitoxin, it can not be considered as distinct from erythrogenic toxin. Erythrogenic toxin probably is not the only factor involved in the toxic manifestations of hemolytic streptococcus infection in man. This seems quite evident from the observations of Kenny and Colebrook[6] on puerperal sepsis. There is some evidence that certain hemolytic streptococci produce a toxic substance when grown in tissue media.[7] However, due to the diverse biological phenomena presented by the erythrogenic toxin, its presence as a "contaminating factor" must be considered in interpreting the results obtained in animals with any filtrate of the hemolytic streptococcus.

TABLE 2

HEAT STABILITY OF ERYTHROGENIC TOXIN: INTRAVENOUS INJECTION OF TOXIN AND TOXIN-ANTITOXIN IN MICE

Toxin*		Dose (ml)	Result	Toxin neutralized by NY 5 antitoxin†
Streptococcus NY 5 (Type 10)	Unheated	1.0	+	–
	Heated 56° C.– 30 min	1.0	+	–
and	" 80° – 30 "	1.0	+	–
	" 100° – 20 "	1.0	–	–
Streptococcus BFO (Type 2)	" 100° – 20 "	2.0	+	–
	" 100° – 60 "	1.0	–	not done
	" 100° – 60 "	2.0	–	" "
	" 100° –120 "	1.0	–	" "
	" 100° –120 "	2.0	–	" "
Broth controls	Unheated	2.0	–	" "
	Heated 100° C.–120 min	2.0	–	" "

(+) = death within 10 min.
(–) = no reaction.
* Contained approximately 2,000,000 skin test doses per ml. Diluted 1:66 to contain approximately 30,000 skin test doses per ml. 1.0 ml. contained 2 M.L.D. (mouse, Table 1).
† Toxins neutralized by equivalent units of antitoxin.

GEORGE E. FOLEY

DEANTIGENATED BEEF BLOOD PLASMA AS A POSSIBLE SUBSTITUTE FOR HUMAN BLOOD PLASMA[1]

SINCE racemization of protein is accompanied by loss of antigenicity, an attempt was made to use this process to deantigenate beef blood plasma with the possibility in mind of using the modified plasma as a therapeutic substitute for human plasma. Beef plasma treated for 15 days at 37° with sodium hydroxide in a concentration of 0.5 normal, after the manner described by Dakin[2] for the racemization of casein, yielded a product which, when neutralized, was highly toxic for guinea pigs on intravenous injection. This toxic action was reminiscent of the action of the anaphylatoxin produced by Vaughan[3] by the treatment of protein with an alcoholic solution of sodium hydroxide. Systematic reduction of the period of incubation of the alkaline plasma progressively reduced the toxicity. It was found that eight hours was the longest period which plasma could be treated without the development of toxic properties manifest on intravenous injection into guinea pigs. The longest period of treatment which gave a product that did not have a primary oxytocic action on the isolated uterus of a guinea pig was one hour. Beef plasma which had been incubated one hour or longer with 0.5 normal sodium hydroxide and then neutralized was no longer antigenic when tested by gross anaphylaxis or by the more sensitive method using uterine strips from guinea pigs sensitized to native beef plasma. Even a five-minute exposure to 0.5 normal alkali destroys most of the antigenicity of beef plasma.

Most of the protein of beef plasma that had been treated for one hour with alkali can be precipitated with acid at pH 4.3 and redissolved in alkali. It can also be precipitated with alcohol, dehydrated with acetone, and the dried powder redissolved in water. In neutral solution the protein can be heated without

[6] M. Kenny and L. Colebrook, *Jour. Path. and Bact.*, 44: 91, 1937.
[7] To be published.

[1] From the Department of Pathology and the Otho S. A. Sprague Memorial Institute, University of Chicago.
[2] *Jour. Biol. Chem.*, 13: 357, 1912; 15: 263 and 271, 1913.
[3] "Protein Split Products," Philadelphia, 1913.

coagulation or apparent alteration of its properties. These facts form the basis of the procedure used in preparing large amounts of the modified plasma for physiologic experiments. Originally ultrafiltration was used to "wash" out the excessive salt formed from the neutralization of sodium hydroxide. This process is slow and bacterial contamination is difficult to avoid. At the present time the routine procedure is as follows. A special citrated beef plasma of low bacterial count is obtained in five-gallon lots (from Armour and Company through the courtesy of Dr. Julius D. Porsche). To each liter of the plasma is added 100 cc of 22 per cent. sodium hydroxide, both of which have been warmed to 37°. The mixture is placed in a 37° incubator for one hour, after which 1.0 normal hydrochloric acid is added slowly with brisk stirring until a reaction of pH 4.3 is reached. The precipitate is separated and washed with a citric acid-disodium phosphate buffer at pH 4.3. The precipitate is then finely suspended in about 700 cc of pyrogen-free distilled water and 30 cc of 22 per cent. sodium hydroxide added slowly as the suspension is vigorously stirred. The protein dissolves very rapidly and as soon thereafter as possible 1.0 normal hydrochloric acid is added until the reaction is pH 7.3–7.4. The volume is then made one liter. If the solution is turbid it becomes clear on warming. It is sterilized by passage through a Berkefeld filter. The final product is a slightly opalescent solution with the appearance and viscosity of serum. An alternative procedure is to neutralize the mixture when it is taken from the incubator and then add 4 volumes of 95 per cent. alcohol. The precipitate is washed several times with 95 per cent. alcohol and finally extracted with acetone until the filtrate is colorless. The protein, when dry, is a fluffy white powder from which solutions of a desired concentration can be prepared by adding saline and heating for about 15 minutes in an Arnold sterilizer. Beef serum can be used, as well as plasma, in the procedure described and gives a satisfactory end product. With serum the solution is lighter in color and can be more easily passed through a Berkefeld filter.

Experiments are under way (in collaboration with Dr. Howard C. Hopps) to find the therapeutic effect of the modified plasma on experimental shock. A normal dog given, while under ether anesthesia, 500 cc of the substance containing 5 per cent. protein showed no change in respiration and a slight rise in blood pressure apparently due to increased blood volume. Allowed to recover, this animal disclosed no untoward effect which might be attributed to the infusion. Dogs brought into shock by massive bleedings have been successively treated by infusion with the modified plasma. Their blood pressure is readily restored and they survive what otherwise would have been fatal shock. An animal used a second time in such an experiment, three weeks after the first experiment, likewise recovered and showed no effect that could be ascribed to a sensitization from the previous infusion.

It is generally believed that the loss of antigenicity which a protein undergoes when treated with strong alkali is due to racemization. The changes produced in beef plasma described above are apparently *not* due to racemization for the following reasons: (1) with complete racemization optical rotation is brought to an irreducible minimum. The optical rotation of modified beef plasma after one hour of treatment with 0.5 normal sodium hydroxide is but slightly altered; (2) with complete racemization the treated protein is no longer digestible by proteolytic enzymes or putrefactive bacteria. Modified beef plasma is readily digested by pepsin and becomes putrefied on standing exposed.

The cause of the loss of antigenicity from short exposure to alkali is not yet fully determined. During neutralization of the alkaline plasma a very strong odor of hydrogen sulfide is given off. This suggests the destruction of cystine and other sulfur-containing amino acids. It is possible that other amino acids, including those that are believed to be necessary for antigenicity of proteins, are also destroyed. If this be true the modified beef plasma may be considered analogous to gelatin which is produced by hydrolysis of collagen. Gelatin is deficient in certain amino acids, a fact which has been related to its lack of antigenicity.

JULIAN H. LEWIS

BOOKS RECEIVED

COONAN, FREDERICK L. *Principles of Physical Metallurgy.* Illustrated. Pp. xi + 238. Harper and Brothers. $3.25.

CRAIK, K. J. W. *The Nature of Explanation.* Pp. 123. Macmillan Company. $1.50.

CUMMINS, HAROLD and CHARLES MIDLO. *Finger Prints, Palms and Soles.* Illustrated. Pp. xi + 309. Blakiston Company. $4.00.

FRAPRIE, FRANK R. and FRANKLIN I. JORDAN. *The American Annual of Photography.* Illustrated. Pp. 243. American Photographic Publishing Co. $1.50.

GLASS, BENTLEY. *Genes and the Man.* Illustrated. Pp. xii + 386. Bureau of Publications, Teachers College, Columbia University. $3.50.

KOLMER, JOHN A. *Clinical Diagnosis by Laboratory Examinations.* Illustrated. Pp. xlii + 1239. D. Appleton-Century.

PRAY, LEON L. *Taxidermy.* Illustrated. Pp. viii + 91. Macmillan Company. $1.49.

TOMKINS, SILVAN S. *Contemporary Psychopathology.* Illustrated. Pp. xiv + 600. Harvard University Press. $5.00.

TURNER, C. E. *Personal and Community Health.* Illustrated. Pp. 585. C. V. Mosby Company. $3.50.

ZMESKAL, OTTO. *Radiographic Inspection of Metals.* Illustrated. Pp. x + 150. Harper and Brothers. $2.75.